

09/297256
430 Rec'd PCT/PTO 28 APR 1999

Practitioner's Docket No. U 012229-2

PATENT

TRANSMITTAL LETTER TO THE U.S. DESIGNATED OFFICE (DO/US)--
ENTRY INTO THE U.S. NATIONAL STAGE UNDER CHAPTER I

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/FI98/00712	11 SEPTEMBER 1998	15 SEPTEMBER 1997
TITLE OF INVENTION		09 DECEMBER 1997
FIRE FIGHTING APPARATUS		
APPLICANT(S)	GORAN SUNDHOLM	

Box PCT
Assistant Commissioner for Patents
Washington D.C. 20231
ATTENTION: DO/US

NOTE: The completion of those filing requirements that can be made at a time later than 20 months from the priority date results from the Commissioner exercising his judgment under the authority granted under 35 U.S.C. 371(d). The filing receipt will show the actual date of receipt of the last item completing the entry into the national phase. See 37 C.F.R. 1.491, which states: "An international application enters the national stage when the applicant has filed the documents and fees required by 35 U.S.C. 371(c) within the periods set forth in § 1.494 and § 1.495."

WARNING: Where the items are those that can be submitted to complete the entry of the international application into the national phase subsequent to 20 months from the priority date, the application is still considered to be in the international stage. And if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. 1.10 must be used (because international application papers are not covered by an ordinary certificate of mailing. 37 C.F.R. 1.8(2)(xi)).

NOTE: Documents and fees must be clearly identified as a submission to enter the national stage under 35 U.S.C. 371, otherwise the submission will be considered as being made under 35 U.S.C. 111. 37 C.F.R. 1.494(f).

CERTIFICATION UNDER 37 C.F.R. 1.10*
(Express Mail label number is **mandatory**.)
(Express Mail certification is optional.)

I hereby certify that this paper, along with any document referred to, is being deposited with the United States Postal Service on this date APRIL 28, 1999, in an envelope as Express Mail Post Office to Addressee, "mailing Label Number EE734098589US addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

DANIELLE JOHNSON

(type or print name of person mailing paper)

Danielle Johnson

Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

*WARNING: Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. 1.10(b).
"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

(Transmittal Letter to the United States Designated Office (DO/US - Entry into National Stage
under 35 USC 371--page 1 of 7) 13-6

EE78 40.98 589 US

1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2808 2809 2810 2811 2812 2813 2814 2815 2816 2

- ## 2. Fees

****WARNING:** *"To avoid abandonment of the application, the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 20 months from the priority date; *** (2) the basic national fee (see § 1.492(a)). The 20-month time limit may not be extended." 37 C.F.R. § 1.494(b).*

****WARNING:** *"To avoid abandonment of the application, the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 20 months from the priority date; *** (2) the basic national fee (see § 1.492(a)). The 20-month time limit may not be extended." 37 C.F.R. § 1.494(b).*

i. ☒ A check in the amount of \$ 485.00 to cover the above fees is enclosed.

ii. ☐ Please charge Account No. _____ in the amount of \$ _____.

(Transmittal Letter to the United States Designated Office (DO/US - Entry into National Stage
under 35 U.S.C. 371--page 2 of 7) **13-6**

A duplicate copy of this sheet is enclosed.

WARNING:

If the translations of the international application, oath or declaration and national fee have not been submitted by the applicant within twenty (20) months from the priority date, the applicant will be so notified and given a period of time within which to file the translation and/or oath or declaration in order to prevent abandonment. The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than twenty (20) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than twenty (20) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 will apply. 37 CAR § 1.494(c); Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35.

3. A copy of the International application as filed (35 U.S.C. 371(c)(2)):

- a. ☐ is transmitted herewith.
- b. ☐ is not required, as the application was filed with the United States Receiving Office.
- c. ☒ has been transmitted
 - i. ☒ by the International Bureau. Date of mailing of the application From form PCT/IB/308): 25 MARCH 1999.
 - ii. ☐ by applicant on _____
Date

NOTE: Section 1.494(b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 20 months from the priority date to avoid abandonment. "The International Bureau nominally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies the applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage and applicant has received notice from the International Bureau, applicant need only pay the basic national fee by 20 months from the priority date." [This can now be paid subsequently with a surcharge.] Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35.

4. A translation of the International application into the English language (35 U.S.C. 371(c)(2)):

- a. ☒ is transmitted herewith.
- b. ☐ is not required as the application was filed in English.
- c. ☐ was previously transmitted by applicant on _____
Date

5. ☒ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. 371(c)(3)):

NOTE: The Notice of January 7, 1993 indicates that 37 C.F.R. § 1.494(d) was "amended to clarify the existing practice that PCT Article 19 Amendments must be submitted by 20 months from the priority date, which time may not be extended." This Notice further advises: "Of course, the failure to do so does not result in loss of the subject matter of PCT Article 19 amendments. The applicant may submit that subject matter in a preliminary amendment filed under Section 1.121. In many cases, filing an amendment under Section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 35. See item 11(c) below.

- a. ☐ are transmitted herewith.
b. ☐ have been transmitted
i. ☐ by the International Bureau. Date of mailing of the amendment (from form PCT/IB/308): _____.
ii. ☐ by applicant on _____
Date
c. ☒ have not been transmitted, as
i. ☐ no notification has been received that the International Search Authority has received the Search Copy.
ii. ☐ the Search Copy was received by the International Searching Authority, but the Search Report has not yet been issued. Date of receipt of Search Copy from form PCT/ISA/202): _____.
iii. ☒ applicant chose not to make amendments under PCT Article 19. Date of mailing of Search Report (from form PCT/ISA/210): _____
iv. ☐ the time limit for the submission of amendments has not yet expired. The amendments, or a statement that amendments have not been made, will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)):

- a. ☐ is transmitted herewith.
b. ☐ is not required as the amendments were made in the English language.
c. ☒ has not been transmitted for reasons indicated at point 5(c) above.

7. ☒ An oath or declaration of the inventor (35 U.S.C. 371(c)(4)) complying with 35 U.S.C. 115

- a. ☐ was previously submitted by applicant on _____
Date

- b. ☒ is submitted herewith, and such oath or declaration
i. ☒ is attached to the application.
ii. ☐ identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or (c) and 5(b); and states that they were reviewed by the inventor, as required by 37 C.F.R. 1.70.
iii. ☐ will follow.

II. Other document(s) or information included:

8. ☒ An international Search Report or Declaration under PCT Article 17(2)(a):
- ☒ is transmitted herewith.
 - ☐ has been transmitted by the International Bureau. Date of mailing from form PCT/IB/308): _____.
 - ☐ is not required, as the application was searched by the United States International Searching Authority.
 - ☐ will be transmitted promptly upon request.
 - ☐ has been submitted by applicant on _____ Date
 - ☐ is not transmitted, as the international search has not yet issued.
9. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98:
- ☒ is transmitted herewith.
Also transmitted herewith is (are)
☒ Form PTO-1449 (PTO/SB/08A and 08B)
☒ Copies of citations listed
 - ☐ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. 371(c).
 - ☐ was previously submitted by applicant on _____ Date
10. ☐ An assignment document is transmitted herewith for recording. A separate
- ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or
- ☐ FORM PTO—1595 is also attached.
- ☐ Please mail the recorded assignment document to:
 - ☐ the person whose signature and address appears below.
 - ☐ the following:
11. ☒ Additional documents
- ☒ Copy of request (PCT/RO/101)
 - ☒ International Publication No. WO 99/13949
 - ☒ Specification, claims and drawing
 - ☐ Front page only
 - ☒ Preliminary amendment (37 C.F.R. § 1.121)
 - ☒ Other FORM PCT/IB/308: TWO (2) SHEETS OF DRAWINGS (FORMAL)
12. ☒ The above checked items are being transmitted
- ☐ before the 18th month publication.
 - ☒ after publication and the article 20 communication, but before 20 months from the priority date.
 - ☐ after 20 months (revival).

NOTE: *Petition to revive (37 C.F.R. 1.137(a) or (b)) is necessary if 35 U.S.C. 371 requirements are submitted after 20 months.*

13. ☐ Certain requirements under 35 U.S.C. 371 were previously submitted by the applicant on _____ namely:
Date

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges if extra claims are authorized.

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 CFR 1.136(a)(3).

NOTE: "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 CFR 1.26(a).

☒ The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 12-0425.

☒ 37 C.F.R. 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: Because failure to pay the national fee within 20 months without extension (37 C.F.R. § 1.494(b)(2)), results in abandonment of the application, it would be best to always check the above box.

☐ 37 C.F.R. 1.492(b), (c), and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment, prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

☒ 37 C.F.R. 1.17 (application processing fees)

☐ 37 CFR 1.17(a)(1)-(5)(extension fees pursuant to § 1.136(a).

☒ 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b)).

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. 1.311(b).

NOTE: 37 C.F.R. 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying or at the time of paying . . . issue fee...." From the wording of 37 C.F.R. 1.28(b): (a) notification of change of

status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

- ☒ 37 C.F.R. 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 20 months after the priority date.

Reg. No. 25,858

Tel. No.: (212)708-1930

Customer No.:


SIGNATURE OF PRACTITIONER

WILLIAM R. EVANS

(type or print name of practitioner)

LADAS & PARRY

P.O. Address

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NEW YORK, NEW YORK 10023

09/297256

510 R&D PET/PTO 28 APR 1999

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: GORAN SUNDHOLM

For: FIRE FIGHTING APPARATUS

Attorney Docket No.: U 012229-2

**Assistant Commissioner for Patents
Washington, D.C. 20231**

Sir:


PRELIMINARY AMENDMENT

Please amend the above identified application as follows:

IN THE CLAIMS

Claim 9, lines 1-2, delete "any one of the preceding claims" and replace therefor -- claim 1--

Respectfully submitted,

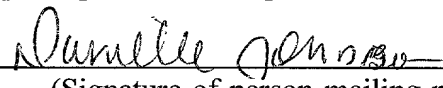


WILLIAM R. EVANS
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26 WEST 61ST STREET
NEW YORK, NEW YORK 10023
REG.NO.25858(12)708-1930

CERTIFICATE UNDER 37 CFR 1.10

I hereby certify that this paper is being deposited with the United States Postal Service on this date APRIL 28, 1999 in an envelope as "EXPRESS MAIL POST OFFICE TO ADDRESSEE" Mailing Label Number EE784098589US addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231

DANIELLE JOHNSON
(Type or print name of person mailing paper)



(Signature of person mailing paper)

NOTE: Each paper or fee referred to as enclosed herein has the number of the "EXPRESS MAIL" mailing label place thereon prior to mailing 37 CFR 1.16(b).

EE78 4.0.98 589 US

FIRE FIGHTING APPARATUS

BACKGROUND OF THE INVENTION

The invention relates to a fire fighting apparatus comprising a plurality of spray heads, a tube system for leading extinguishing medium from an extinguishing medium source having a volume for extinguishing medium to the spray heads, at least one drive gas source for driving extinguishing medium at a high pressure via the tube system to the spray heads and release means for activating at least one of the spray heads. Such fire fighting apparatuses are known e.g. from the International Patent Application with the publication number WO 92/22353.

Prior art fire fighting apparatuses comprise one container or a number of containers for extinguishing medium, the containers being positioned adjacent to each other and arranged to deliver extinguishing medium via a tube system to spray heads or sprinklers. The length and shape of the tube system depend on the application and the operating principle. Fire fighting apparatuses for bigger spaces, such as hotels, ships and industrial buildings, often have long tube systems.

The source of extinguishing medium of the fire fighting apparatuses in said applications can be e.g. the water mains, or a water container, from which water is pumped to the spray heads. Alternatively, the source of extinguishing medium can be a water bottle, to which is coupled a pressure gas bottle capable of driving the water (or another extinguishing medium) out of the bottle to the spray heads. Such a combination constitutes a hydraulic accumulator.

Long tunnels are technically particularly difficult spaces to extinguish a fire in. The tunnels can have a length of several kilometres - even some ten kilometres - and a diameter of e.g. 3 metres. The tunnels often contain cables. A cable fire may cause great damage. Extinction of a fire in such long tunnels is assumed to be so difficult to arrange for technically that, in most cases, the tunnels do not contain any fire fighting system at all. In case if the length of the tunnel is some kilometres and the intention is to lead extinguishing liquid, such as water, into the tunnel via a tube from one end thereof to a distance of some kilometres from said tunnel end, a drive pressure so high is required that, on account of pressure losses in the tube, it cannot be generated, in practice.

BRIEF DESCRIPTION OF THE INVENTION

The object of the present invention is to simplify the construction of such fire fighting apparatuses that are used for extinguishing fires in different major spaces and buildings and that are especially well suitable for use in long tunnels and the like. For this purpose, the invention is characterized in that
5 said at least one drive gas source is coupled to a long tube constituting part of the tube system in such a way that the tube together with said at least one drive gas source constitutes a hydraulic accumulator and the volume of the source of extinguishing medium is constituted by the volume of the tube at
10 least to a substantial extent. A long tube means in this connection primarily a tube having a length of the size of about 1 km and more.

An especially preferred embodiment of the invention is characterized in that a plurality of drive gas sources are arranged at a predetermined distance from each other along the tube. This embodiment suits particularly
15 well for fighting fires in tunnels, the tube being in such applications a substantially straight tube. Here, the tube system has been built into the tunnel in the longitudinal direction thereof and the tube is preferably divided into a number of main sections, each one containing a drive gas source. The main sections are preferably divided into a number of zones, each one containing a group of
20 spray heads or sprinklers. One group or several groups of spray heads or sprinklers are released at fire, when required.

Preferred embodiments of the invention are presented in attached claims 2 to 12.

An essential feature of the invention is to utilize the tube as a
25 source of extinguishing medium for a hydraulic accumulator. Another essential feature is to position a number of drive gas sources along the tube, whereby the pressure losses can be kept on an acceptable level, and to use the tube as the source of extinguishing medium. This is possible, because the tube is long and may contain a relatively big volume of extinguishing medium. No
30 separate liquid containers are needed for extinguishing liquid, when the tube is used as the source of extinguishing medium. The consumption of extinguishing medium will be small, when the spray heads used are of a type producing mist-like spray. Such a spray head is presented e.g. in the International Patent Application with the publication number WO 92/22353.

35 Thanks to the invention, a fire fighting apparatus has been provided which has a simple structure and installation and which is not dependent on

outer drive sources, such as electricity and pumps, and which, in addition, suits especially well for extinguishing fires in long tunnels. There is no need of separate sources of extinguishing medium, such as liquid bottles, and these can be omitted. The fire fighting apparatus is environment friendly when the
5 extinguishing medium is water-based liquid.

BRIEF DESCRIPTION OF THE DRAWING

In the following, the invention will be described by means of two embodiments with reference to the attached drawing, in which:

10 Figure 1 shows a tunnel containing a fire fighting apparatus according to the invention;

Figure 2 illustrates a drive source of the fire fighting apparatus;

Figure 3 shows a cross-section of the tunnel of Figure 1;

15 Figure 4 shows a tunnel containing another embodiment of the fire fighting apparatus of the invention;

Figure 5 shows the drive source for the fire fighting apparatus of Figure 4; and

Figure 6 shows a cross-section of the tunnel of Figure 4.

20 DETAILED DESCRIPTION OF THE INVENTION

Figure 1 illustrates a tunnel 1 for cables, in which tunnel is mounted a fire fighting apparatus according to the invention. The tunnel is e.g. 10 km long. A tube system is positioned in the tunnel 1 extending from one end thereof to the other end, the system comprising a long tube 2, from which extend shorter tubes 3a to 3e and 4a to 4e leading to spray heads or sprinklers
25 5a to 5e and 6a to 6e, respectively. The spray heads may be of the type presented in the International Patent Application with the publication number WO 92/22353 and having a k factor of 1,9. The spray heads have at least two, but typically a plurality of nozzles, which are arranged geometrically in relation to
30 each other in such a way and have such an opening and such a scattering angle that they produce a penetrating mist-like spray at high drive pressure. The consumption of extinguishing liquid is small in spite of that a long throw is achieved. The drive pressure is e.g. 70 bar.

The length of the tube 2 is divided into a number of zones A, each
35 of them having a length of 22.5 m. In Figure 1, a zone A has eight spray

heads, i.e. the spray heads 5b to 5e and 6b to 6e, the distance between the spray heads adjacent to each other being 7.5 m. The eight spray heads form a group of spray heads arranged to be released simultaneously in case of fire within the zone A. The upper spray heads 5b to 5e in the group are arranged to spray to the right along the tunnel 1, while the lower spray heads 6b to 6e are arranged to spray in the opposite direction. Because the spray heads 5b to 5e are arranged one after the other in Figure 1, the sprays intensify each other. This is also true of the spray heads 6b to 6e. In the vicinity of each spray head, a suction is built up by the spray head itself when spraying, said suction taking in the extinguishing medium that is sprayed out of the spray head positioned behind: for example, the suction at the spray head 5c takes in the extinguishing medium coming from the spray head 5b. The suction at the spray head 6e is capable of taking in part of the extinguishing medium coming from the spray head 5d, and the suction at the spray head 5b is capable of taking in part of the extinguishing medium coming from the spray head 6c, though these spray heads are directed in the opposite direction. In this way, a circulation of mist-like extinguishing medium is provided upon activating the spray heads, which medium extinguishes the fire effectively. Reference numerals 7a to 7e indicate solenoid valves, or another type of valves, making the spray heads be released in the group desired. Accordingly, the solenoid valve 7a controls the spray heads 5a and 6a; and the solenoid valves 7b to 7e control the spray heads 5b to 5e and 6b to 6e. Figure 1 shows a situation in which the spray heads 5b to 5e and 6b to 6e have been released, while the spray heads 5a and 6a in the adjacent zone have not been released. The maximum number of spray heads being released at a fire may e.g. be $8 + 4 + 4$, the spray heads existing in three adjacent zones A. At fire extinction, a demand for a 10 min extinction by means of four spray heads may be 47 l gas at a pressure of 150 bar together with 150 l water or water-based liquid. In case if the maximum number of spray heads, i.e. 16, are released during a time of 30 min, $3 \times 4 \times 150 \text{ l} = 1800 \text{ l}$ water is required. At the beginning of the spraying, the maximum pressure in the spray heads is kept at about 100 bar.

The reference numerals 8a and 8b indicate fire detector devices. These can be smoke detectors, detectors sensitive to heat or, in principle, any detectors giving a signal to the solenoid valves 7a to 7e. The fire detector 8a gives a signal to the solenoid valve 7a and opens this, while the fire detector 8b gives a signal to the solenoid valves 7b to 7e and opens these.

Figure 2 shows that the tube 2 comprises nitrogen bottles 9 to 12 and stop/opening valves 13 to 15 arranged in such a way that there always is one nitrogen bottle and one stop valve at the distance of 1 km. The nitrogen bottles 9 to 12, which together with the tube 2 form hydraulic accumulators, provide the extinguishing medium in the tube with a high pressure. The volume of the nitrogen bottles 9 to 12 is 50 litres and the pressure is 250 bar. The pressure loss in the tube 2 will be 133 bar at the maximum for the parameters stated. The loading pressure may preferably be within the pressure range of 30 to 400 bar, preferably 100 to 300 bar, depending on the length of the tunnel.

When the tube 2 is 10 km long and has an outer diameter of 25 mm and a wall thickness of 2.5 mm, the content of the tube will be about 3000 litres. Accordingly, the tube 2 contains about 3000 litres of water or water-based liquid, when the installation is in a standby state and the apparatus is ready to be released.

To begin with, the water in the tube 1 is obtained from a water mains 16 at a pressure higher than 3 bar. Reference numeral 17 indicates a filter and reference numeral 19 a valve enabling a filling of the tube 2. The valve 19 is open when the filling of the tube 2 with water is started. After the tube has been filled, the valve 19 is closed.

Figures 4 to 6 show another embodiment of the invention. Reference numerals used in the Figures 4 to 6 correspond to those used in the Figures 1 to 3 for the respective parts, an apostrophe being an extra addition. The embodiment of Figures 4 to 6 differs from the embodiment of Figures 1 to 3 therein that spray heads 5b' to 5e' in a group of spray heads or sprinklers to be released simultaneously are directed (orientated) differently. In the embodiment of Figure 4, a circulation of a mist of extinguishing medium is not provided, but all spray heads 5a', 5b' to 5e' spray downwards. It is conceivable that spray heads (not shown) are arranged downwards in the tunnel 1' to spray in the direction towards the spray heads 5e', 5b' to 5e' to provide a circulation of extinguishing medium, as described above. Another difference is that the tube 2' is arranged in a separate channel outside the tunnel 1'. A further difference is that only one solenoid valve 7' controls a whole group of spray heads 5b' to 5e' or sprinklers. From Figure 6 appears that the cross-section of the tunnel 1' is rectangular and from Figure 5 appears that the length of the tunnel is 3.6 km. No fire detector is drawn in Figure 4, though it

may exist, as described in connection with Figure 1. In case if 5b' to 5e' indicate sprinklers, i.e. spray heads with an ampoule being released by heat, the release of the group of sprinklers can be arranged to occur with any sprinkler of the group, whereby this releases the other sprinklers belonging to the group, preferably as described in the International Patent Application with the publication number WO 93/10860.

The invention is described above by means of one embodiment only, and therefore, it is pointed out that the details of the invention can be implemented in many ways within the scope of the attached claims. Accordingly, the length of the tube 2 may vary from the described one. In the application of the invention for extinguishing a fire in a tunnel, the tube length referred to is of the size of at least about 1 km and typically several kilometres, though a tube length of only some hundred metres can be actual in certain applications. It is conceivable that sprinklers, i.e. spray heads with separate release means, such as ampoules bursting at increased temperature, are possible instead of spray heads receiving a signal from a detector. Hereby, it is a sprinkler of a group of sprinklers in a zone (A) which makes the other sprinklers belonging to the zone be released. The fire fighting apparatus may comprise both sprinklers and spray heads, e.g. in such a way that a sprinkler is arranged in each zone (A) to release the spray heads existing in said zone. The length of the zones may vary as may the number of spray heads/sprinklers in the zones. Instead of nitrogen, the content of the gas bottles can be carbon dioxide, argon or another gas suitable for the purpose or a gas mixture at high pressure. The fire fighting apparatus may be installed in major spaces other than a tunnel, as was mentioned earlier.

CLAIMS

1. A fire fighting apparatus comprising a plurality of spray heads (5a to 5e, 6a to 6e; 5a', 5b' to 5e'), a tube system (2, 3a to 3e, 4a to 4e; 2', 3a', 3e') for leading extinguishing medium from an extinguishing medium source
5 having a volume for extinguishing medium to the spray heads, at least one drive gas source (9 to 12; 9' to 12') for driving extinguishing medium at a high pressure via the tube system to the spray heads and release means (8a, 8b) for activating at least one of the spray heads, **characterized** in that said at least one drive gas source (9 to 12; 9' to 12') is coupled to a long tube
10 (2; 2') constituting part of the tube system in such a way that the tube together with said at least one drive gas source constitutes a hydraulic accumulator and the volume of the source of extinguishing medium is constituted by the volume of the tube at least to a substantial extent.
2. A fire fighting apparatus according to claim 1, **character-**
15 **ized** in that a plurality of drive gas sources (9 to 12; 9' to 12') are arranged at a predetermined distance (l) from each other along the tube (2; 2').
3. A fire fighting apparatus according to claim 2, **character-**
ized in that a stop/opening valve (13 to 15; 13' to 15') for closing and opening the flow of extinguishing medium in the tube (2; 2') is arranged between
20 individual drive gas sources (9 to 12; 9' to 12').
4. A fire fighting apparatus according to claim 2, **character-**
ized in that the tube (2; 2') is divided into a number of main sections (l), each of them containing a drive gas source (9; 9') having a high pressure.
5. A fire fighting apparatus according to claim 4, **character-**
25 **ized** in that the drive gas sources are constituted by nitrogen bottles (9; 9') having a pressure of 30 to 400 bar.
6. A fire fighting apparatus according to claim 4, **character-**
ized in that the main sections (l) comprise a number of zones (A), each of them containing a group of spray heads (5b to 5e, 6b, 6e; 5b' to 5e') or sprin-
30 klers.
7. A fire fighting apparatus according to claim 6, **character-**
ized in that release means (8a, 8b) are arranged along the tube (2; 2') within the zones (A) for releasing a group of spray heads (5b to 5e, 6b to 6e; 5b' to 5e') belonging to respective zone.
- 35 8. A fire fighting apparatus according to claim 7, **character-**
ized in that each group of spray heads (5b to 5e, 6b to 6e; 5b' to 5e') con-

tains a solenoid valve (7b to 7e; 7') to control at least one spray head belonging to the group (5b to 5e, 6b to 6e; 5b' to 5e').

9. A fire fighting apparatus according to any one of the preceding claims for being used in a tunnel (1; 1'), **characterized** in that the
5 tube system (2, 3a to 3e, 4a to 4e; 2', 3a', 3e') follows the longitudinal direction of the tunnel (1; 1').

10. A fire fighting apparatus according to claim 9, **characterized** in that the spray heads comprise first spray heads (5b to 5e) arranged in an upper part of the tunnel (1) and second spray heads (6b to 6e) arranged
10 in a lower part of the tunnel, whereby the first spray heads are arranged to spray mainly in the opposite direction with respect to the second spray heads.

11. A fire fighting apparatus according to claim 1, **characterized** in that the spray heads (5a to 5e, 6b to 6e; 5a' to 5e') are of a type capable of producing a mist-like spray.

15 12. A fire fighting apparatus according to claim 1, **characterized** in that the extinguishing medium is water-based liquid.

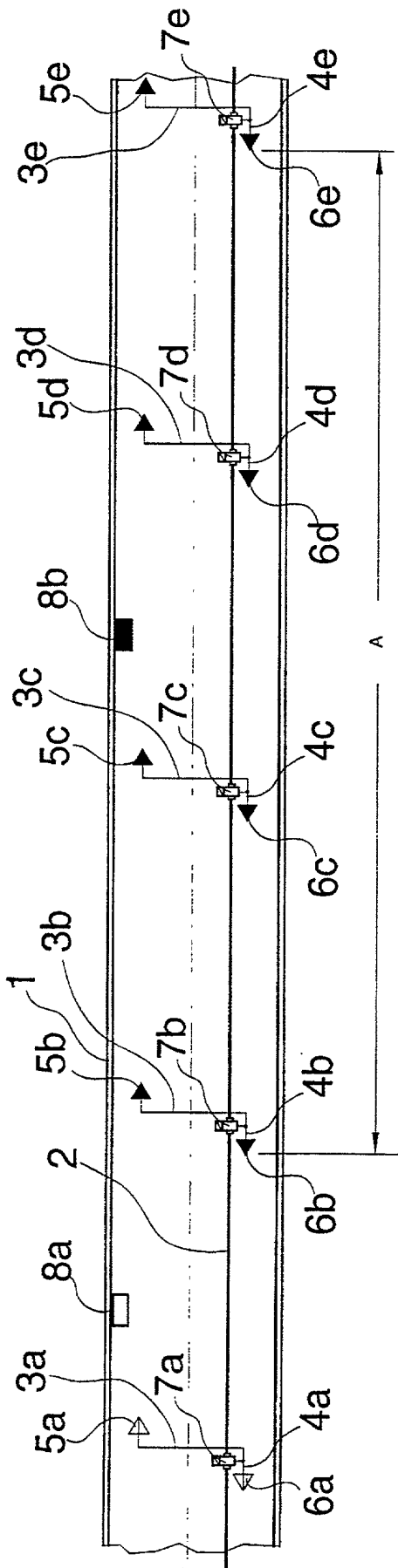


Fig 1

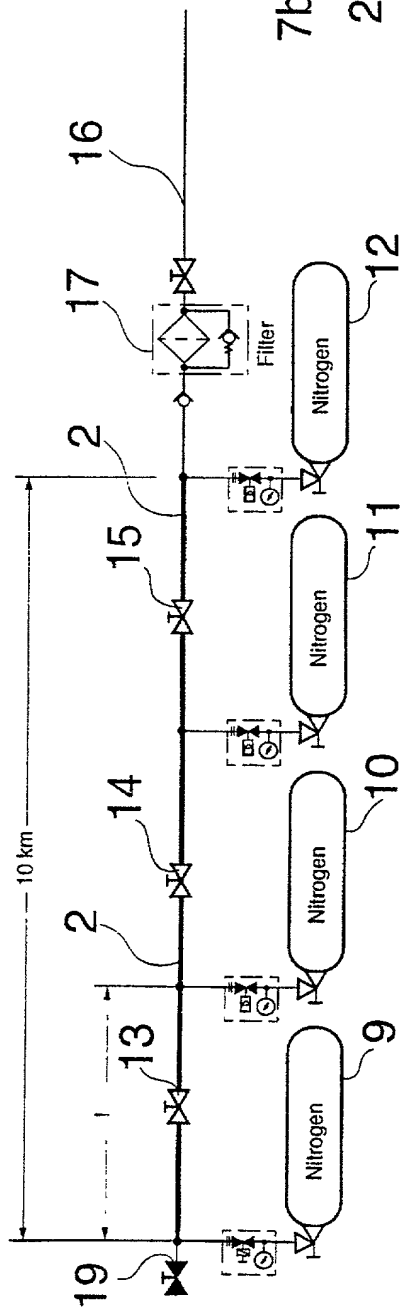


Fig 2

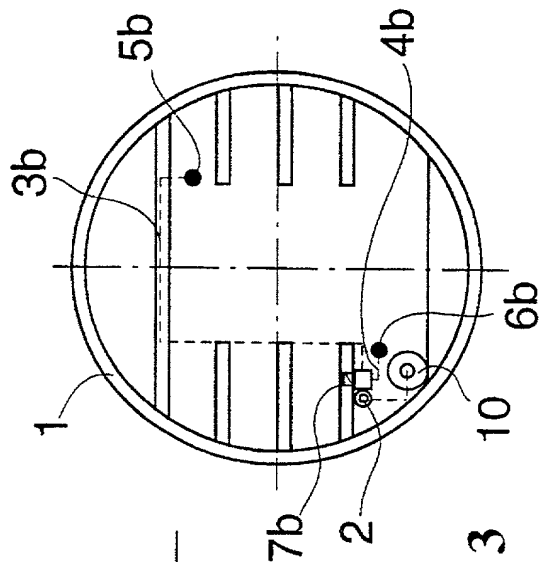


Fig 3

2/2

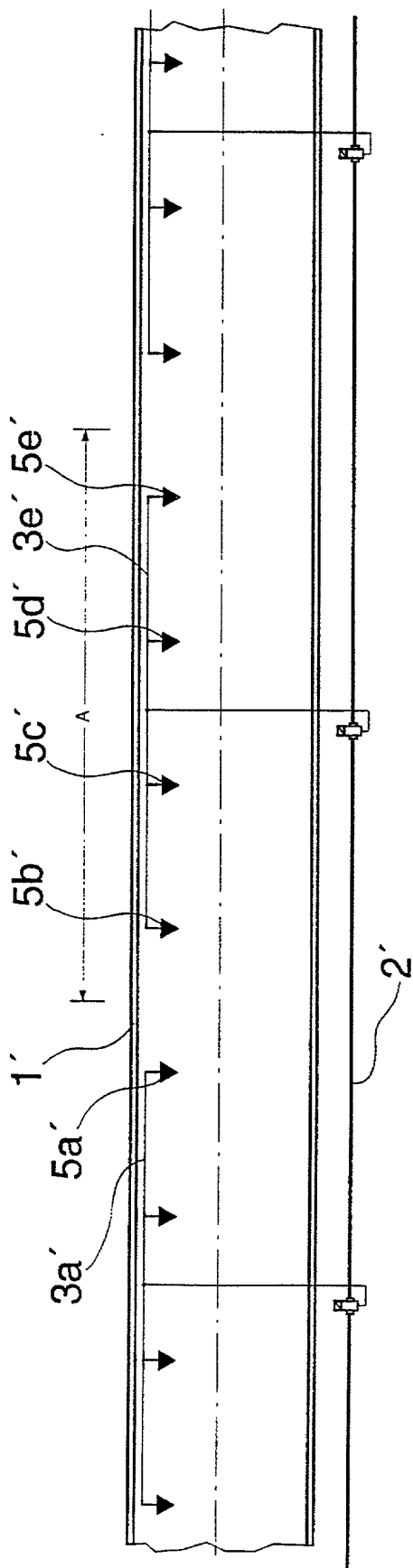


Fig 4

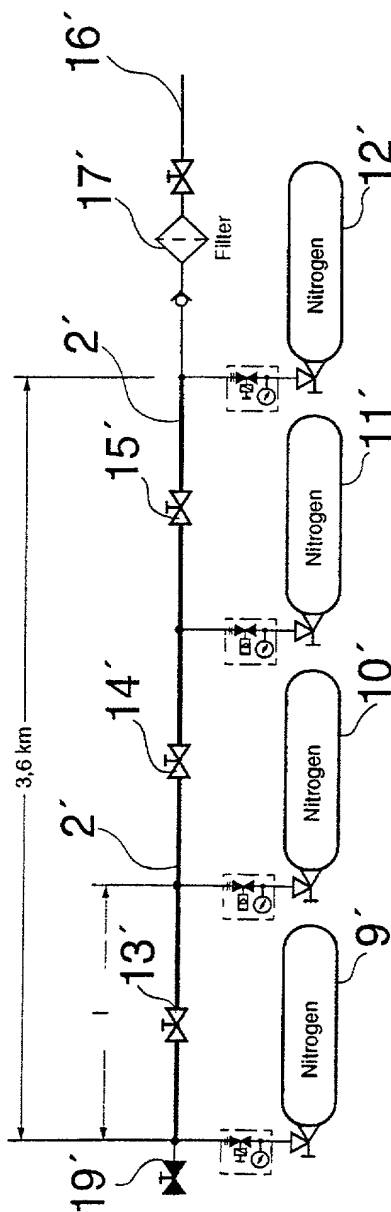


Fig 5

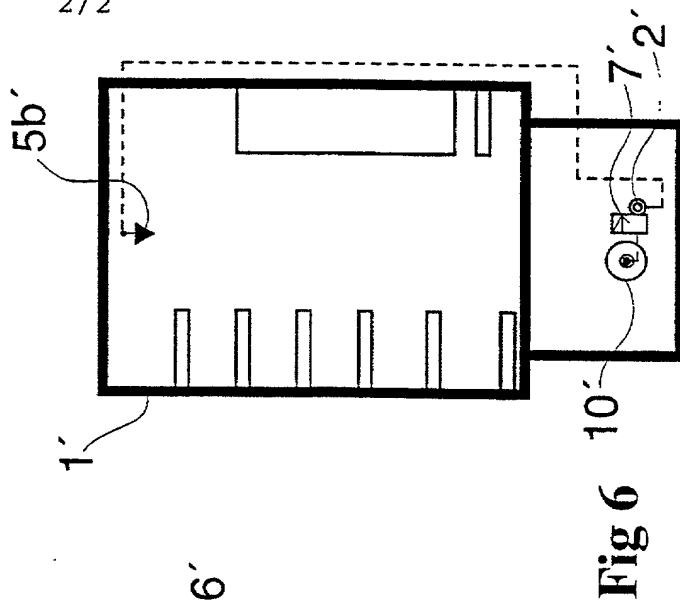


Fig 6

Attorney's Docket No. U 012229-2**PATENT****COMBINED DECLARATION AND POWER OF ATTORNEY**(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,
CONTINUATION OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

(check one applicable item below)

- ☐ original.
☐ design.
☐ supplemental.

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

- ☒ national stage of PCT.

NOTE: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.

- ☐ divisional.
☐ continuation.
☐ continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

 Fire fighting apparatus

(Declaration and Power of Attorney [1-1]—page 1 of 7)

SPECIFICATION IDENTIFICATION

the specification of which:

(complete (a), (b) or (c))

(a) ☐ is attached hereto.

NOTE: "The following combinations of information supplied in an oath or declaration filed on the application filing date with a specification are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(1) name of inventor(s), and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration on filing;

"(2) name of inventor(s), and attorney docket number which was on the specification as filed;
or

"(3) name of inventor(s), and title which was on the specification as filed."

Notice of July 13, 1995 (1177 O.G. 60).

(b) ☐ was filed on _____, as ☐ Serial No. 0 / _____
or ☐ _____
and was amended on _____ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

NOTE: "The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(1) name of inventor(s), and application number (consisting of the series code and the serial number; e.g., 08/123,456);

"(2) name of inventor(s), serial number and filing date;

"(3) name of inventor(s) and attorney docket number which was on the specification as filed;

"(4) name of inventor(s), title which was on the specification as filed and filing date;

"(5) name of inventor(s), title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or

"(6) name of inventor(s), title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number; e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration."

Notice of July 13, 1995 (1177 O.G. 60).

(c) ☒ was described and claimed in PCT International Application No. PCT/FI98/00712, filed on 11 September 1998 and as amended under PCT Article 19 on _____ (if any).

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

- ☐ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and
- ☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

- (d) ☐ no such applications have been filed.
- (e) ☒ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

**PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)**

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
FI	973695	15/09/1997	<input checked="" type="checkbox"/> YES NO <input type="checkbox"/>
FI	974465	9/12/1997	<input checked="" type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(34 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER

FILING DATE

_____/_____
_____/_____
_____/_____

**CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S)
UNDER 35 U.S.C. 120**

- ☐ The claim for the benefit of any such applications are set forth in the attached ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART (C-I-P) APPLICATION.

(check proper box(es) for any of the following added page(s)
that form a part of this declaration)

☐ **Signature** for fourth and subsequent joint inventors. Number of pages added _____

* * *

☐ **Signature** by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. Number of pages added _____

* * *

☐ **Signature** for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. Number of pages added _____

* * *

☐ Added page for **signature** by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 CFR 1.47)

* * *

☐ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-I-P) application.

☐ Number of pages added _____

* * *

☐ Authorization of attorney(s) to accept and follow instructions from representative.

* * *

(if no further pages form a part of this Declaration,
then end this Declaration with this page and check the following item)

☒ This declaration ends with this page.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

Full name of sole or first inventor

Göran

(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

Sundholm

FAMILY (OR LAST NAME)

Inventor's signature

Date 31.3.1999

Country of Citizenship Finland

Residence Ilmari Kiannon kuja 3, FIN-04310 Tuusula, Finland

Post Office Address same as above

Full name of second joint inventor, if any

(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

FAMILY (OR LAST NAME)

Inventor's signature

Date

Country of Citizenship

Residence

Post Office Address

Full name of third joint inventor, if any

(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

FAMILY (OR LAST NAME)

Inventor's signature

Date

Country of Citizenship

Residence

Post Office Address

**ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

NOTE: If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete **ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION** for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.

POWER OF ATTORNEY

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

(list name and registration number)

13- JOSEPH H. HANDELMAN, 26179
JOHN RICHARDS, 31053
RICHARD J. STREIT, 25765
ALAN K. ROBERTS, 17777
S. DELVALLE GOLDSMITH, 14383

PETER D. GALLOWAY, 27885
IAIN C. BAILLIE, 24090
THOMAS F. PETERSON, 24790
RICHARD P. BERG, 28145
JULIAN H. COHEN, 20302
WILLIAM R. EVANS, 25858
JANET I. CORD, 33778
CLIFFORD J. MASS, 30086

(check the following item, if applicable)

- ☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

LADAS & PARRY
26 WEST 61st STREET
NEW YORK, NEW YORK 10023

(212) 708-1930

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

(Declaration and Power of Attorney [1-1]—page 5 of 7)